CQ TV

AUGUST 1971

75

THE JOURNAL OF B A T C

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EDITORIAL

Now I know that when you see the word "Subscriptions" again you will probably turn over to another page straight away, but as curiosity will almost certainly bring you back, here is my message.

Have you sent in your annual subscription yet? Unfortunately, now that we charge £1.00 we're becoming inundated (or rather our treasurer is) with vast numbers of you only sending us ten bob. A few wouldn't have mattered, but since its so many of you - may we have our extra 50p please? Its only a little to you, but so much to us.

Those of you who live outside U.K. will know that if you pay your £1.00 sterling or $4 U.S.A. you will receive your copy of C Q - T V by surface mail. Which means about two days to Switzerland and over a month to Africa! So we will for a small surcharge, send the journal by airmail. A list of the annual surcharges is printed below for most of the countries we post to; if we have left your country out, sorry, but the treasurer has a full list and can tell you if you write to him (address on page 1).

Australia	£2.16	or $4.80
Austria	£0.32	or 20Sch.
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Canada	£1.80	or $4.50
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Greece	£0.32	or 24Dma.
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Italy	£0.32	or 500L
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Norway	£0.32	or 5.6Kr.
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S.Africa	£1.80	or 3.6R
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U.S.A.	£1.80	or $4.45
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To save us on postal charges we've decided to stop, for a trial period, issuing receipts for subscription renewals. C Q - T V will be your receipt! If you buy goods from Club Sales you will of course, still receive a receipt, but not for normal subscriptions. In one month alone this cost £12 in stamps and we just can't afford it. Incidentally, please do print your name and address on renewal forms - sometimes it takes hours to decipher some of your names, or even weeks of research through records. Save our treasurer some time and write clearly.

If you are looking for a 931A socket, the Club Sales Officer (address on page 1) has some ex-equipment ones available for only 10p inclusive of postage. Quite a bargain!

We have been asked to remind members who are /T that the tv allocations in 70cm is 425 - 429MHz and 432 - 445MHz. Awkward figures to remember, I know, but important to remember if you are transmitting.

Several members recently have mentioned a very useful book of circuits which they have found. It is the 'Sourcebook of Electronic Circuits' by John Marcus, published by McGraw-Hill Book Company at £9.25. Rather expensive, but well worth a borrow from the library.

The Editor.

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THE CQ·TV SPG

A TRIPLE STANDARD MONOCHROME SPG using TTL.

by A. W. Critchley Dip El, C Eng, MIERE.

The Synchronising Pulse Generator is the heart of the T.V. system and as such should be a reliable piece of equipment. The modern approach of using digital techniques has made S.P.G.'s so reliable as to be forgotten - they just work away quietly and are never touched from one day to the next.

Unfortunately, digital techniques usually mean complication and expense.

The design of this S.P.G. falls somewhere in between the digital types and the more common type using monostables, and represents a maximum performance for a reasonable outlay. It does not seem possible to simplify the design any further without dispensing with some desirable feature. The principle is to use two monostables only to generate the basic line-timings, to use these to provide the other line-timed signals, and finally to derive all field-rate timing digitally. The reason for this use of monostables is that to do the line-timings digitally would mean using shift registers and counters - virtually doubling the cost.

Circuit Description

All the basic arrangements for this S.P.G. have been mentioned in the recent series on I.C.'s in CQ-TV 71 to 74.

The circuit description starts with the Master Oscillator in Fig.1. which runs at the twice-line frequency of 31.25KHz (The 625 standard is assumed for purposes of description).

A schmitt-trigger NAND-gate N1B with a feedback integrating network forms the oscillator and is quite stable with both voltage and temperature changes. The 10K ohms potentiometer VR1 gives about 5% change of frequency either side of the mean. The output of the oscillator triggers a monostable N2 which generates 4.7µS pulses. These are the 'gaps' between the broad pulses (which constitute Field Sync) of 27.3µS.

On pin 11 of this monostable is a negative-going waveform of sawtooth shape which is extracted via an emitter-follower VT1 to avoid loading the timing circuit. This waveform appears at the emitter and is coupled to the schmitt-input of a second monostable N3. Here the triggering is from the positive slope at the particular voltage set by the control and is independent of the input pulse length. The result is a delay of less than the 4.7µS pulse and in fact it is set to be 3µS which is 1.7µS (i.e. the Front Porch width) less than the Broad Pulse gaps. We now have the correct timings for Line Blanking and the start of Line Sync and N3 is arranged to provide the Line Blanking pulse width of 12.05µS. An emitter-follower, VT2, similar to the first, feeds two schmitt-trigger NAND-gates N4A & B, which produce two positive pulses of 6.5 and 4µS. These are used to obtain Line Drive and Equalising Pulses respectively. All pulses, so far, are at twice-line frequency. **See Fig.3.**

Counters

The Line Blanking Monostable $\overline{Q}$ output is used as the trigger for a four-stage counter, N5 to 8, and also a second single-stage counter N9. Each of these stages is arranged to count by five (for 625). At the end of the main counter chain, an invertor N11D, and differentiating network C12, R29 give a positive-going pulse of about 3µS width and 50Hz, which is then cleaned up by two more invertors N14B & C. The timing of this pulse is about 250nS after Line Blanking leading-edge due to the ripple delays in the counter chain. The reset-zero inputs of all the counter stages are fed with this signal although only the second single-stage counter really need be.

Departure from Conventional means

So far the circuitry has followed more-or-less conventional lines but now we come to the difference. The Second counter N9 is used to count out the number of equalising and Broad pulses - the two being the same whatever the standard chosen. But because the number is not necessarily a submultiple of the number of lines a second counter is necessary and it has to be forced into the correct condition by the 50Hz reset pulse. See Fig.4D. For 625 it counts by 5 - the same as the first stage of the main counter - (which could be used instead for 625 only). The output of N9 is used as the clock pulse to a J-K bistable N12A whose C-input is fed with the 50Hz Reset-pulse and whose K-input is earthed. The sequence of events is that the Reset-pulse clears the bistable to make Q low. Resetting the counter N9 creates a single clock pulse at its output (but not on 625 though) which would clock the bistable if the C-pulse were not 3µS or so - i.e. longer than the time taken to generate this odd pulse. The C-input overrides any other input. The next occurrance is a clock pulse 5 half-lines later from N9. See Fig.4. Now, because the bistable J-input is high, the bistable

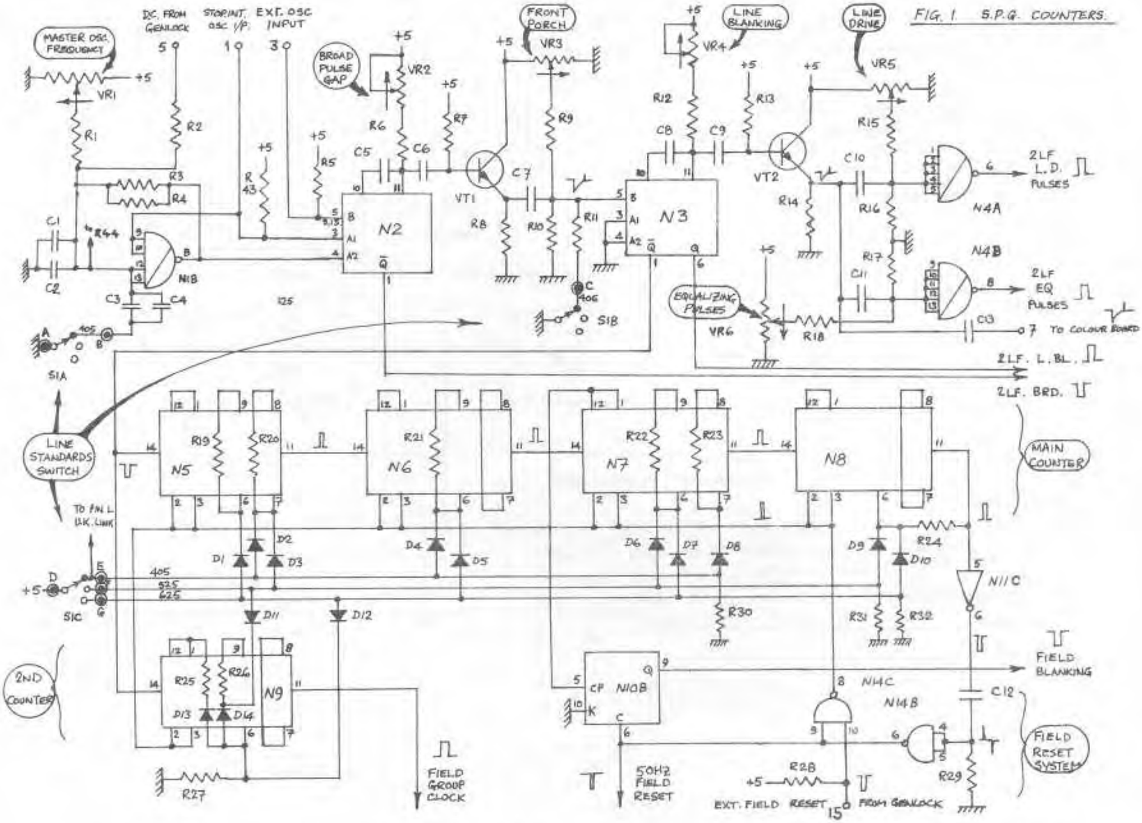


FIG. 1 S.P.G. COUNTERS.

can clock Q-up. Five half-lines later on another clock pulse arrives but the bistable, having K-low, cannot change Q-down again and indeed no further pulses will do so, until the C-input is cleared.

This results in a 5-unit wide pulse following the Reset pulse - once per field only - Fig.4E.

Field Drive

A shift register N12B, cross-coupled and cleared to prevent trouble with the odd pulse, and using the same clock pulse feed as the bistable, provides another 5-units wide pulse after the first one, and a third shift register N13A gives a third 5-units pulse after that. These three pulses correspond to the First Equalising pulse period, the Broad Pulse period, and the Second Equalising period in Composite Syncs. Furthermore, in total, they correspond to Field Drive. So field drive is made by means of a 3-input NAND-gate N1A fed with these pulses in negative form. The gate is actually the four-input Schmitt-trigger NAND-gate, that partners the oscillator, used as a NAND-gate. Since the three pulses are Synchronous there are no gaps between them. See Fig.4G.

The output stage consists of two invertors in parallel and gives 2V into 75 ohms - see CQ-TV 73. p.12.

Field Blanking

A similar, but simpler, system is used to generate Field Blanking. The main Counter ratios are arranged so that the first two stages always count by a number equal to the number of lines in Field Blanking (taking the standard specification into account).

Since the Counter runs at twice-line frequency it follows that a further divide-by-two stage would enable an output pulse duration to be obtained equal to Field Blanking Duration.

However, a suitable clock pulse occurs at the correct time on pin 9 of the third counter - on every standard. Thus an extra bistable is not necessary. See Fig.4H & M.

It should be noted that the latch N10B is clocked only by the first of the negative-going edges from N7 pin 9.

FIG 2. S.P.G. LOGIC

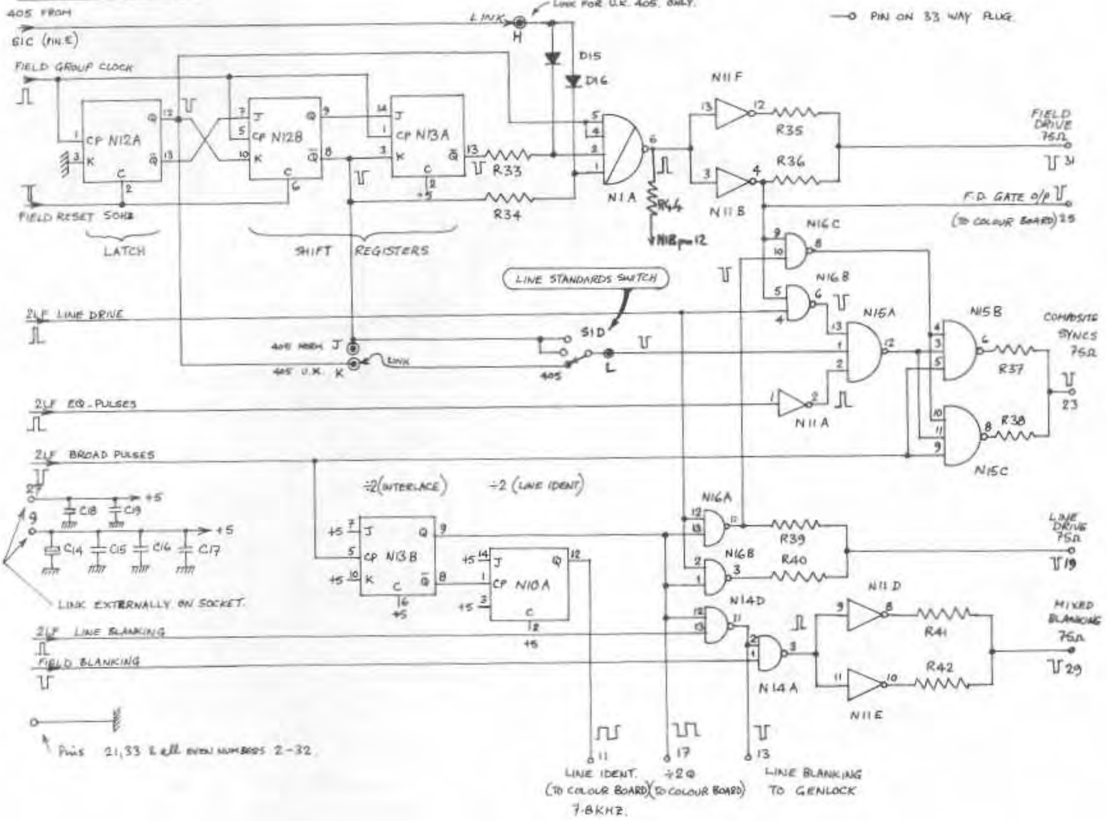


Fig.7 shows a simplified counter-chain for 625/525 only where the extra divide-by-two counter is included in order to generate a shortened Field Blanking to match C.C.I.R. standards rather more closely.

Mixed Blanking

To obtain Mixed Blanking, the twice-line frequency Line Blanking pulse has to be reduced to line frequency and this is done in a NAND-gate N14D fed from a divide-by-two bistable N13B, clocked by the earliest pulse available (Broad pulse-trailing-edge) NOT reset by anything at all.

The resulting Line frequency, Line Blanking is then applied to another two-input NAND-gate N14A with Field Blanking and the result is Mixed Blanking which finally ends up as 2V into 75 ohms.

Line Drive

Line Drive needs to be frequency-halved also, and so another two-input NAND-gate 16A & B is fed with the output of N4A and the same output of N13B used previously. However, this NAND-gate consists of two NAND-gates in parallel to give directly the 2V output of Line Drive.

Composite Syncs

Now we come to the complicated part in the compiling of composite syncs. This is made as follows:

Field Drive from N11B is used to stop the twice-lind frequency Line Drive pulses from passing through NAND-gate N16C during the Field Drive of 15 units. The gate output remains high during this time and is fed to one input of a three input NAND-gate, N15A. A second input is a negative pulse from the first shift register N12B; this is the second of the three five-input pulses. The third input consists of positive-going 4µS wide Equalising pulses from the Schmitt NAND-gate N4B.

The output of NAND-gate N15A consists of twice-line frequency line Drive, two groups of 4µS pulses and a 'high' period of 5 units - See Fig.5H.

This output feeds one input of the parallelled output gates N15B & C. A second input comes from a two-input NAND-gate N16C fed with Field Drive and Line frequency Line Drive (or 42$\overline{Q}$ output if easier to get at). The output of this gate is Line frequency Line Drive pulses with a 15 unit wide 'high' region See Fig. 5C.

Fig 3 Line Timings (Idealized) for 625

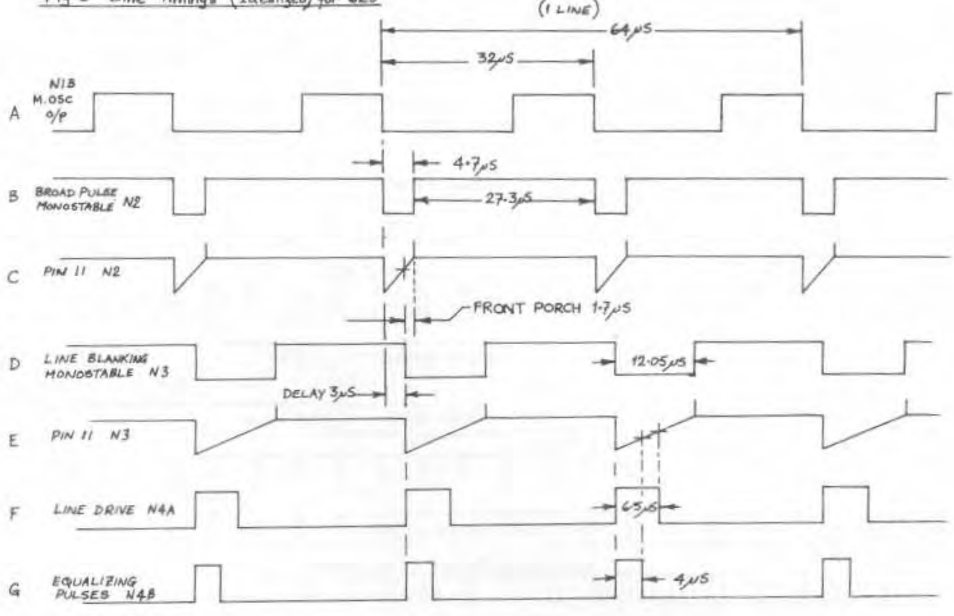


Fig 4 Field Timings for 625

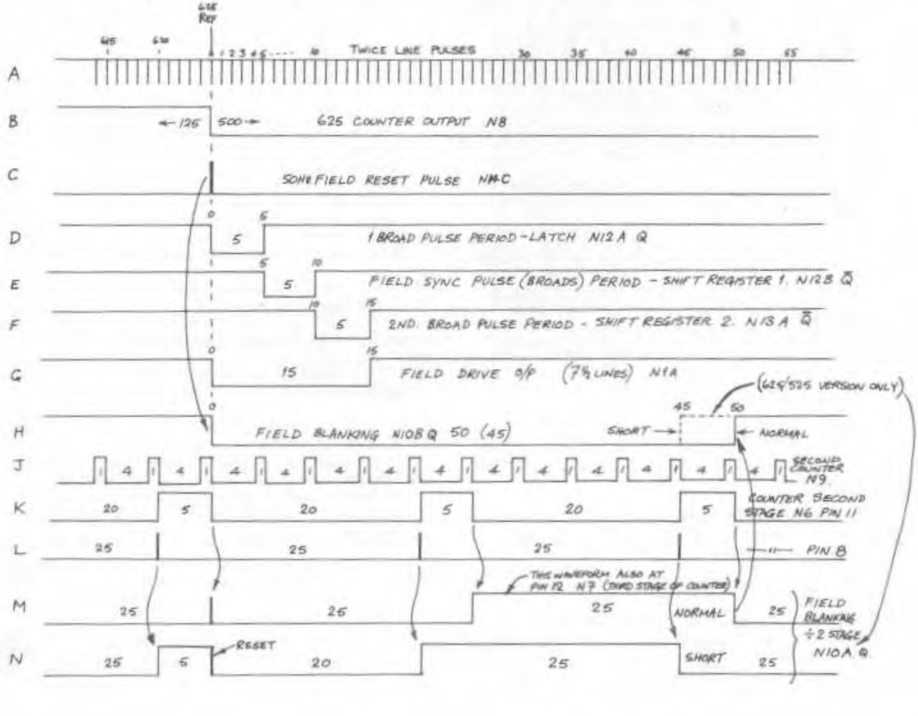
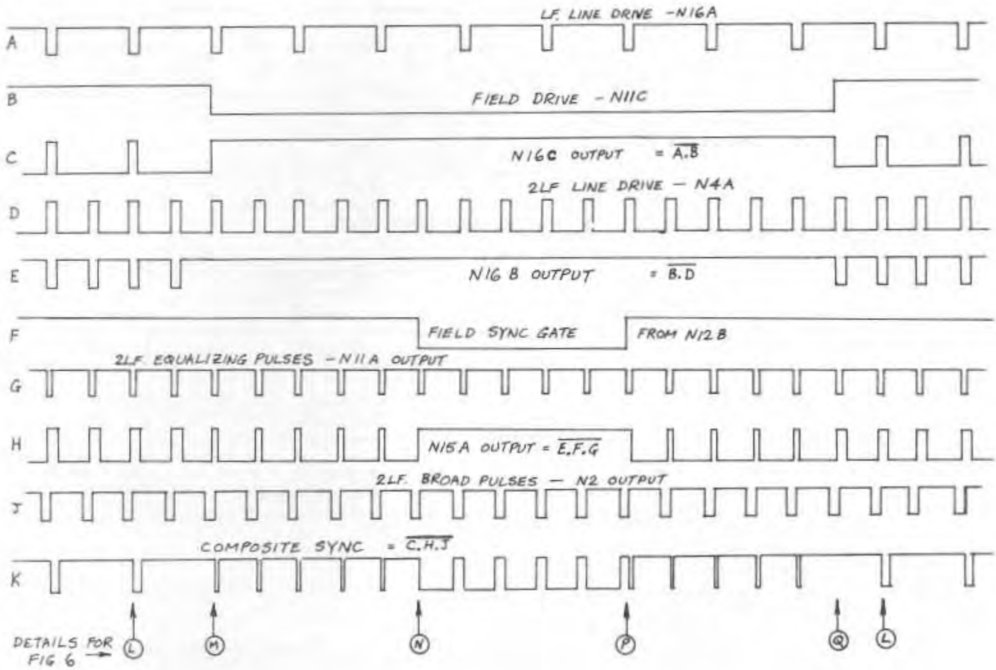

625 REF
615
620
1 2 3 4 5 ---- 10
TWICE LINE PULSES
30
35
40
45
50
55
A
B
← 125
500 →
625 COUNTER OUTPUT N8
C
50Hz FIELD RESET PULSE N14C
D
0
5
5
1 BROAD PULSE PERIOD - LATCH N12 A Q
E
5
10
5
FIELD SYNC PULSE (BROADS) PERIOD - SHIFT REGISTER 1. N12B Q̄
F
10
15
5
2ND. BROAD PULSE PERIOD - SHIFT REGISTER 2. N13 A Q̄
G
0
15
15
FIELD DRIVE o/p (7½ LINES) N1A
(625/525 VERSION ONLY)
H
0
45
50
FIELD BLANKING N10B Q 50 (45)
SHORT →
← NORMAL
J
1
4
SECOND COUNTER N9.
K
20
5
20
5
20
5
COUNTER SECOND STAGE N6 PIN 11
L
25
25
25
PIN 8
M
25
25
THIS WAVEFORM ALSO AT PIN 12 N7 (THIRD STAGE OF COUNTER)
25
NORMAL
25
FIELD BLANKING ÷2 STAGE N10A Q.
N
25
5
RESET
20
25
SHORT
25

Fig 5 Forming Composite Syncs


LF LINE DRIVE -N16A
A
B
FIELD DRIVE - N11C
C
N16C OUTPUT = $\overline{A.B}$
2LF LINE DRIVE - N4A
D
E
N16 B OUTPUT = $\overline{B.D}$
F
FIELD SYNC GATE
FROM N12 B
2LF EQUALIZING PULSES - N11 A OUTPUT
G
H
N15A OUTPUT = $\overline{E.F.G}$
2LF BROAD PULSES - N2 OUTPUT
J
COMPOSITE SYNC = $\overline{C.H.J}$
K
DETAILS FOR FIG 6 →
Ⓛ
Ⓜ
Ⓝ
Ⓟ
Ⓠ
Ⓛ

The third input to the output gates is negative-going Broad Pulse 'gaps'. - See Fig.5J.

Taking only C & H as inputs to these gates would give a Line frequency Line Drive with 10, 4µS pulses and a high region of 5 units.

Adding the third input, J, fills in the 'high' region with 5 'proper' Broad pulses of 27.3µS. It also removes 1.7µS from the leading edges of both of the other pulses. i.e. 6.5µS Line frequency Line Drive becomes 4.8µS Line Sync at Line frequency and the 4µS pulses become 2.3µS Line Equalising pulses at twice-line frequency.

In other words Composite Syncs.

Standards Switching - 525

This calls for some apparent complication which is in fact simplification.

525 line operation entails changing the count of the first two main counter stages N4 & 5 from 5 & 5 to 3 & 7 - giving 21 lines Field Blanking.

The second counter N9 is changed to count by 6.

The method employed to do this is not to physically switch the feedback loops but to paralyse some of them and allow others to operate by means of +5V applied, or not applied, to the counter gate inputs. The 1K ohms resistors prevent trouble with having +5V on the counter output collectors. Since several loops are involved and a single switch is used, the back-to-back diodes are required for isolation purposes. The voltage drop of 0.6V across these is of no consequence and the gate is hauled up to +4.4V and that particular loop is turned off.

If this method were not used - some 10 switch poles would be necessary.

Line timings are adjusted as follows:-

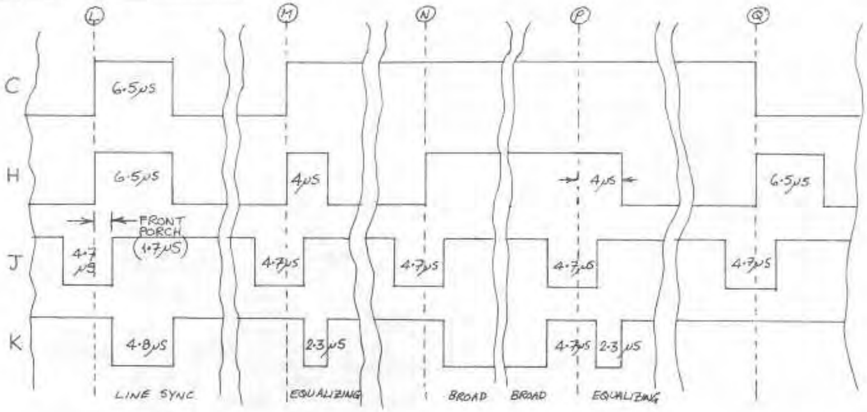
Firstly the Master oscillator frequency is raised slightly by adjusting VR1.

The Broad pulse monostable time ought to be tweaked slightly to 4.6µS. This would change the front porch by a slight amount to just less than 1.7µS because the delay in triggering the second monostable is determined by the voltage at the Schmitt-input and not by the frequency. So the 3µS delay is always the same proportion of the first monostable delay.

However, in practice the first monostable need not be altered for 525.

Line Blanking has to be reduced to 10.8µS. This automatically reduces Line Drive to 5.4µS and Equalising pulses to 3.3µS (before being shortened)

Fig 6 Sync – Details of fig 5



and a slight adjustment of these two may be desirable, to make them 6.3 and 3.8µS respectively.

However, the departure from the specification is so slight as not to warrant any presetting for amateur use. Inspection of the various standards reveals that the basic pulse widths are of much the same proportions of each other and so only the two monostables delays need normally be adjusted.

405

This is rather awkward as the U.K. system does not have Equalising pulses and the Field Sync Pulse occurs at the start of Field Blanking - lasting for 4 lines.

In this S.P.G. there is the choice of this system or a system with Equalising pulses as per 525 and 625.

For the latter, the main counter ratios become 3, 5, 3 & 9 - giving field blanking of 15 lines.

The second counter N9 is changed to count 8 to give 4 lines of Equalising and Broad Pulses (8 to each of the 3 periods).

The oscillator frequency has to be lowered to 20.25KHz and the two monostables changed by some 50%. The other three controls need not be tweaked far.

To change to the Standard U.K. System we need also to do the following:-

The first equalising pulses are omitted by paralysing the two shift register outputs at the inputs to NAND-gate N1A by means of D15 & 16 taken to + 5V from the standards switch S1C.

Therefore Field Drive now consists of only the one pulse of 8 units. At the same time S1D switches the Field Sync source to the latch output of N12A. This is the first of the three periods instead of the second. Since the Field Sync insertion period now lasts as long as the Field Drive, there will be only Broad Pulses - no Equalising Pulses.

The divide-by-8 count is obtained by three feedback loops to 2 inputs - two of the loops being via a diode AND-gate, D13 & 14.

Simplification

If, U.K. 405 is not required then switch 1D can be removed and R33 & R34 shorted out.

D15 & 16 can also be removed.

If 405 is not required at all, then the second counter N9 can be eliminated and its output being instead the feed from pin 11 of N5. This is O.K. for 625, but for 525 another ÷2, Field reset, Bistable must be inserted, in this feed, to give 6 pulses per period. Also the Main Counter third and fourth stages N7 & 8 need not be switched at all, but the loops left in from pin 8 to pins 6 & 7. However, since an extra ÷2 is required and two are included in these two stages it would be silly not to use them. So these two stages are rearranged to free the ÷2 parts and to use only the ÷5 parts. The third stage ÷2 can now be used for Field Blanking and the other one can be used on 525 for the ÷6 system bistable. Thus one less I.C. is required (SN7490N). See Fig.7.

Shortened Field Blanking

By feeding the Field Blanking ÷2 stage from pin 8 of the second stage of the main counter instead of from pin 11, Blanking becomes 22½ lines which is a better approximation to C.C.I.R. standard of 22 lines than 25 (UK standard). 525 Field Blanking would become 19½ lines and 405, 13½ lines.

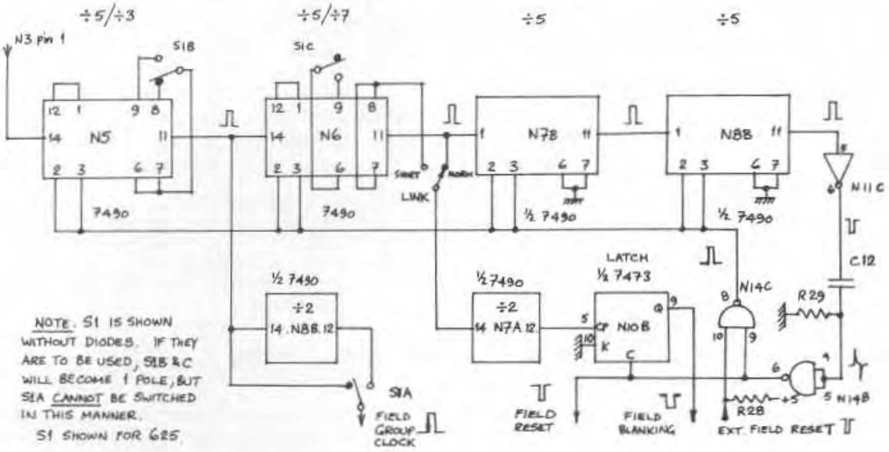
Adding Colour Pulses

Extra I.C.'s can be added to provide a Burst Gate pulse and Line Ident Squarewave for colour working, (on the Genlock board).

There is a bistable (N10A) unused for monochrome pulses. This is put to use as the divider for line Identification (7.8KHz) and is triggerred by the interlace divider $\bar{Q}$ output (N13B) for convenience.

The output of this divider is made available at the plug and is intended to be fed to a buffer stage

Fig 7 Simplified Counter for 625/525 only (Incorporating a choice of Field Blanking Length)



NOTE. S1 IS SHOWN WITHOUT DIODES. IF THEY ARE TO BE USED, S1B & C WILL BECOME 1 POLE, BUT S1A CANNOT BE SWITCHED IN THIS MANNER.

S1 SHOWN FOR 625

on a second board which contains the other additional colour parts and the genlock. It is not suitable for for feeding a 75 ohm load.

The next issue of CQ-TV will give the details of the colour pulses generation.

Burst-gate Blanking would be a simple 7½ lines per field but this is no great discrepancy from the 'Bruch' Blanking of 9 lines per field. (which moves over a 4 field sequence in order to give a constant burst phase after the field period).

Setting up

This is very simple and all standards follow the same procedure - refer to the Specification table for figures.

1. Adjust Master Oscillator frequency to 31.25KHz. (or the Field drive output to 50Hz.)

2. Set the first monostable to give 4.7µS.

3. Set the delay between this and the second monostable to 3µS (i.e. Front porch to 1.7µs).

4. Set the Second Monostable to give 12.05µS pulses, for Line Blanking.

5. Set Line Drive to 6.5µS - or Line Sync to equal the Broad pulse 'gaps'.

6. Set the Equalising pulses to be half as wide as sync pulses.

7. Colour Pulses - Set Burst gate to be 5.5µS after Line Sync leading-edge and width to be 2.25µS (about the same as equalising pulses.)

It should be about central in the back Porch.

Genlock and Construction

The second and final part in the next issue of CQ-TV will describe the simple genlocking system. It will also give a printed circuit layout suitable for a 7" x 4.4" I.S.E.P. board or similar sized board - e.g. to fit into a large Eddystone Box. The Genlock-Board will be separate. Other constructional details will be given, together with a suitable Power Supply circuit.

References

1. CQ-TV NO.70-74.

2. CQ-TV 63, 64, 68.

ACKNOWLEDGEMENTS

The author wishes to thank the Directors of E.M.I. Electronics Ltd., for permission to publish this article.

PARTS LIST

INTEGRATED CIRCUITS

N1, 4	SN7413N
N2,3	SN74121N
N5-9	SN7490N
N10,12,13	SN7473N
N11	SN7404N
N14,16	SN7400N
N15	SN7410N

CAPACITORS

C1,3	22nF
C2	47nF
C4,9	10nF
C5,12	1nF
C6	1.5nF

C7	220nF
C10,11,13,15) 16,17,18,19)	100nF
C8	2.2nF
C14	200μ 6V

DIODES

1-16	1N914 or equivalent

TRANSISTORS

VT1,2	ZTX314 or equivalent npn

RESISTORS ¼w (0.4" spacing)

R1,6	6.8K	R43	1K
5,7,9,10,12,15,} 16,27,30,31,32 }	10K	R44	300K
R2	220		
R3,17	1.8K		
R4, 14,25,26, } 29,33,34 }	470		
R8,19,20,21,22, } 23,24,28 }	1K		
R11	1.5K		
R13	2.7K		
R17	3.9K		
R18	4.7K		
R35-42	33 ohms		

VARIABLE RESISTORS

VR1-6	10K ohms min. Carbon preset (Horiz). Note: VR1,3,5 & 6 can be 1K to 22K

SWITCH

3-way 4 pole

PLUG (or pins if preferred)

33-way I.S.E.P.	32-213-023
Spacer	34-007-001

PRINTED CIRCUIT BOARD (if required)

1/16" single sided

BOARD CONNECTION PINS

Harwin 2088 12 off

BRACKET FOR STANDARDS SWITCH

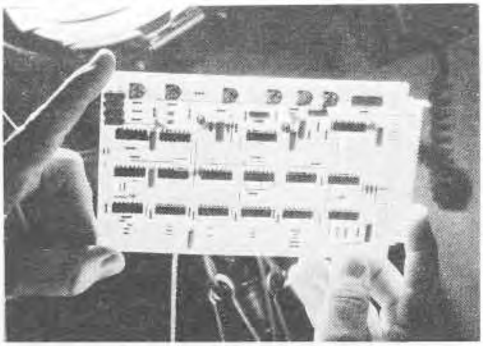
To suit switch used.

Specification & Performance

	Osc Freq.	Broad Pulses		Front Porch		Line Blanking	Line Drive	Eq.Pulses Generated	Eq.Pulses Actual	Line Sync	Field Blanking		Field Drive	EQ. Pulses	Broad Pulses	Burst Gate Delay	Burst Gate Width
	KHz	ON μS	OFF μS	Delay μS	Actual μS	μS	μS	μS	μS	μS	Normal- Lines	Short Lines	Lines			μS	μS
405	20·25	39·95	9·4	7·9	1·5	18·00	9·7	6·00	2·60*	6·3	15	13½	4(or 12)	8+8*	8	—	—
525	31·50	27·15	4·7	3·0	1·7	11·00	6·0	3·65	1·95	4·3	21	19½	9	6+6	6	5·25	2·3
625	31·25	27·3	4·7	3·0	1·7	12·05	6·5	4·00	2·30	4·8	25	22½	7½	5+5	5	5·75	2·3

* 405 Alternative has NO Equalising Pulses.

Field Drive Starts at Line Drive Leading-Edge, which starts at Line Blanking Leading-Edge time.



A view of the S.P.G. built on a single printed circuit board

Errata In the diagram of the field sync waveform in "The 625 Standard" published in C Q - T V 74 the duration of field blanking should have been 22 lines and not 18.

IN THE NEXT C Q - T V

Converting U.H.F. Tuners for 70cm.
Digital Sync Pulse Generators.
All the regular columns again.

LETTERS TO THE EDITOR.

Dear Sir,

Perhaps an active TV amateur should say something about standards. In the West London area the following stations are regularly active; G6ADJ/T, G6OPB/T, G6AFD/T, G6AFA/T, G6AFL/T, ALL are on 625 and I for one have no intention of putting my cameras back to 405. Indeed, G6OPB/T transmits colour and what amateur would consider 405 for this? As for sound frequencies, FM spaced 6MHz from the video carrier is the obvious choice. It is easy to attain as any other two carrier system, and the receiver is already built into the tv set.

I would also point out that as far back as I can remember the BATC stand at the Radio Communications Exhibition has operated on 625, using equipment from many stations, much of it having never been interconnected before.

R.G. Skegg G3ZGO G6ADJ/T
Acton, London.

Dear Sir,

Enough of this bickering between television amateurs about line standards.

Surely it is fairly easy to distinguish the conditions under which 405 or 625 should be used, and what factors will affect these.

1) Colour Transmission As the only domestic receivers available are 625 PAL it seems logical for amateurs to adopt this standard too.

2) Weak signal working Clearly as a 625 signal occupies more bandwidth than a 405 one for the same Tx power, the 625 line signal will have a poorer signal/noise ratio. Against this, a colour tv delay line could be used, reducing horizontal and vertical definition, to make a 405 line signal no better than a 625 one.

3) Strong signal working 625 will give better resolution and occupy more space in the band than a 405 one. Thus for strong signal working neither standard is better.

4) Surplus broadcast equipment With the networks change to 625 much surplus 405 gear has become available. Obviously it would be foolish not to take advantage of this for the next few years, particularly if this encourages more 70cm activity.

5) Domestic receivers. Similar argument to(4), but in a few years time surplus 405 receivers will not be available and hence there will be no means for newcomers to join the hobby. One of the great things about amateur tv has always been that anyone could receive it with the minimum of difficulty. If, in 10 years time, we are still transmitting 405 and there is no means for a new enthusiast to receive them, then we have lost a potential new user of 432MHz. Compare the HF situation where the almost universal change to SSB has resulted in a drop of new HF enthusiasts and S.W.Ls. Trouble is, ATV cannot afford to lose such people!

With these thoughts in mind, the following seems to me to be the most logical policy:-

1) Use the current surplus 405 equipment to encourage new 70cm activity to prevent loss of the band.

2) Aim to produce 625 by 1980. This means new equipment must be capable of 625 - or at least, if you are just starting bear 625 in mind and don't make a future change difficult.

3) Adopt the BBC System, 625 standard.

4) Try to get some 625 reception facility working - you wouldn't wish to miss out on any portable station who was just passing - and you will encourage local transmissions.

In some areas the 625 date could be even earlier, say 1975 in the Midlands and the North and perhaps even earlier in London.

I write this letter in reply to "Active Amateur" who suggests "625 is out". Well, perhaps at the moment he is right. But if we stick to this approach then we may find in twenty years time that amateur television is a diminishing hobby with not enough 432MHz bandspace for one TV channel.

405 and 625 line transmissions both have a place in amateur television, and it is my contention that 625 line transmissions will become of increasing inportance during the next 10 years.

We are at such a stage in semiconductor evolution that building new equipment is no longer the bind it was. A modern I.C. 625 pulse generator will take up about as much space as, and much less current tahn, two valves out of an old 405 pulse generator - and can be built in only a few hours. The change to 625 need not be rapid, it does not have to be difficult but it is my contention that within the next 10-20 years it will have to come if amateur television is to remain the growing hobby we know today.

D.J. Taylor G8ARV G6SDB/T
Dudley, Worcs.

SLOW SCAN NEWS

1st WORLD SSTV CONTEST Despite the lack of publicity this contest received in U.K. (due to the postal strike) there was no lack of support for this event. In fact, Franco Fanti the organiser estimates that 99% of the worlds SSTV stations were active during the event! The results are as follows:

1	W9NTP	Score	680
2	W6YY/K6STI		615
3	WB6SMG		480
4	WIVRK		345
5	W7FEN		270
6	WA7LQO		240
7	PA0LAM		180
8	W1JKF		170
9	WB6OMF		75
10	K4TWJ		45
11	W4UMF		35
12	G3ZGO		20
13	ZL1AOY		20
14	SZ0CG		10
15	EA4DT		5

SWL Prize: Sue Miller W9GNW

Robert Skegg G3ZGO G6ADJ/T of Acton has sent some photos of his recent contacts. We print here a caption received from I1LCF and a portrait received from SM5DAJ. A CR100 and loft dipole were used, feeding a home designed SSTV monitor, but a HW32 is also used. Robert has made two-way contacts with SV1AB, I1LCF, I1CAM, EA4DT, W1VRK, FG7XT, KL7DRZ, and SZ0CG and comments that he would have done better in the World Contest if he had more power and if the Birmingham Boat Show hadn't pinched the SSTV frequency!

Harold Jones G5ZT G6ABC/T has now started in Slow Scan and reports that in the first 14 days he had two-way contacts with 18 stations on 14MHz and three on 21MHz, these being W4TB, FG7XT and W4UMF, all G firsts. Harold also received 9VIPW Singapore, but as there was no monitor there, his pictures were not received.

Equipment is a Robot camera and monitor a TR10 TS510 Transceiver, a TX599 transmitter and a JR599 receiver.

G5ZT as received by W4MS on 14230KHz on 26th May

POSTBAG

Richard Frederick K4UGC of Miami, U.S.A. writes to say that he is now operating a "Lingmitter" amateur transmitter. This he has modified to have a 2m strip feeding into a Amprex 5894 tripler, to a 5894 final, modulated by a 5763. His camera is a four lens turret Sylvania and aerials are a 4 element skeleton slot and a 5 element Yagi. Transmitting frequency is around 440MHz. Richard is also interested in S.S.T.V. AND in reading C Q - T V!

Peter Blakeborough 6Y5PB G6ACU/T sends this photo of himself at Silver Hill, Jamaica. Pete is now operating slow scan using a transistor monitor built round a 5FP7 and a FTDX 100 SSB transceiver, just managing to get on the air for the SSTV world contest. In this he claims the first two-way contact slow scan from Jamaica.

P.O. Wenham of Portsmouth Polytechnic assures us that the students of Pompey haven't forgotten B.A.T.C. but have just been too busy with their exams! He asks if any B.A.T.C. members in the area would like to help with the plan for a Southern A.T.V. Group - the College radio club having been diluted with an excess of non-tv people.

Malcolm Burrell of Ilford, Essex has produced his own vidicon and now has good pictures from it. He has used timebase circuits from C Q - T V 65 (changing some transistor types and raising the voltage rail) and the blanking amplifier from C Q - T V 69. Malcolm has been following John Lawrences "Circuit Notebook" and finds it very useful - has built some of the designs from the series with great success.

E.F.J. Hoare G6RZD/T G8BDJ of Southwick, Sussex, writes giving details of his rig. Using 405 line positive mod., he has 40 watts peak white input to a 6/40A. The camera is a transistorised vidicon and the modulator the two transistor one by 'AEV/T (see C Q - T V no 73). 'RZD/T has built many modulators but says "this one beats them all". The off air probe is from C Q - T V 56. Using an 8/8 slot beam 40ft A.S.L. pictures have been received in Worthing (7miles) and Shoreham (2 miles). Combined sound and vision is the next project.

Steve Fogarty ZL2ASF writes from New Zealand about their channel allocations there. The band goes from 421 to 449MHz and amateurs have split this into four channels, A-C. Steve has 80 watts input using channel C, with a F.S.S. and a vidicon, and his signals have been received 35 miles away. He also raises an interesting point - What is the current U.K. two-way Dx record? Is it still G3ILD - G6NOX/T?

John P. Kivleham WA9SJS from near Chicago is a recent new member and writes about activity in his area. Commenting that very few people use interlaced scanning now, John describes how initial hook-ups are made via 2 meter F.M. phone. After an F.M. sound subcarrier is used on the 440MHz video carrier.

Geoff Douglas-Smith G8CPX of Dunstable, Bedfordshire has recently become active of 70cm vision (on 437.5MHz) using 20 watts input, to a Multibeam antennae. Several stations are active in the vicinity, all, including Geoff, using 405 line positive modulation.

F. Huggins of Colne, Lancashire is busy building a slow scan monitor using a 3FP7 in the G3ZGO circuit. Another amateur nearby, G3UEU, is also interested and will be building one as well - looks like a lot of SSTV activity in Colne soon.

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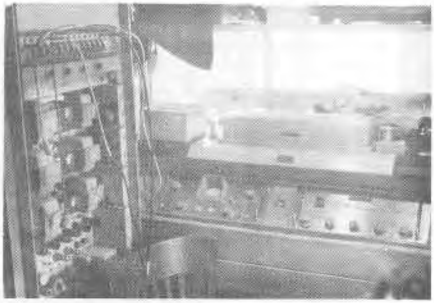
BATC AT THE VHF

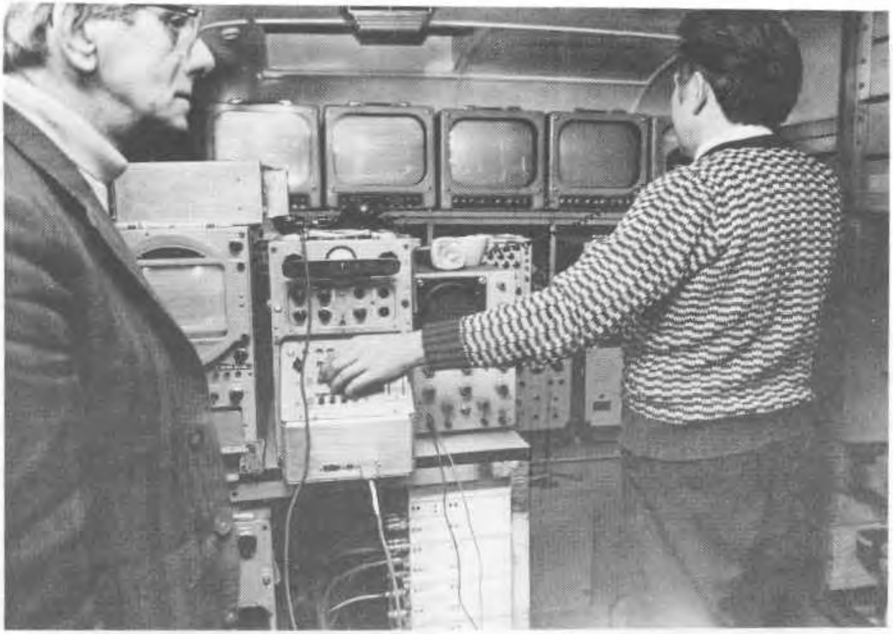
The B.A.T.C. was invited to attend this years London V.H.F. Convention which was held at Twickenham on Saturday 17th April. At this convention B.A.T.C. was allocated one hour in which to "Review the state of the Art of ATV". This was very successfully done by a brief review of the equipment on show and covered most aspects of ATV.

A brief outline of the "Aims and Objects" of B.A.T.C. was given followed by details of how to go about receiving ATV off air. A typical transistorised UHF tuner was shown and conversion details were given for adapting it to receive ATV copies of which were given away free. This was followed by a working demonstration of Slow Scan TV by Robert Skegg G3ZGO of London, which in turn was followed by a demonstration and talk by Dave Lawton G6ABE/T on Electronic Character Generation and gating of a call sign onto an incoming video signal. Tom Mitchell G6APC/T then talked about his I.C. Pulse Generator for 625 lines and Malcolm Sparrow G6KQJ/T showed his digital I.C. Pulse Generator on 405 lines. All of this was followed by Joe Rose G6STO/T describing his B.A.T.C. outside broadcast vehicle which he demonstrated with help from his family and Alan Watson. Equipment in the van included C.C.U.s and power units for the 4 3 inch I.O. cameras and a 2 inch video tape recorder (which Joe says he has already had working playback). The intention, says Joe, is to build in 70cm transmitters and receivers and make "Monoculus", as it is named, self-contained.

These camera channels were used to assist the afternoon lectures, not only for B.A.T.C. but also the main V.H.F. lecture on microwaves today.

B.A.T.C. would like to thank all those who helped on this occasion and assure all members that a first rate publicity job was done for B.A.T.C.





Cover Photo "Monoculus" the BATC OB van outside the Winning Post Hotel where the 1971 VHF Convention was held.

Above Inside "Monoculus"

Right One of the cameras from "Monoculus" with Ian Lever as cameraman.

Opposite page top Malcolm Sparrow lecturing at the Convention.

Opposite page centre The Video Tape Recorder installed inside "Monoculus".

Opposite page bottom Joe Rose, the owner of the OB Unit, standing outside the door.

Photographs by courtsey of P.M. Fletcher and I.R. Lever.

CONVENTION

INTEGRATED CIRCUITS

PART 5.

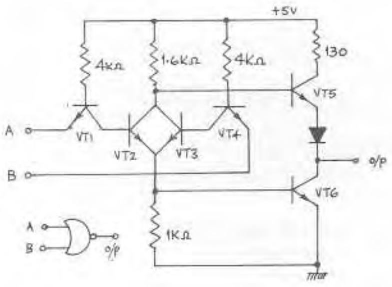
A.CRITCHLEY Dip El; C Eng; MIERE.

T.T.L. Odds and Ends

The NOR-gate

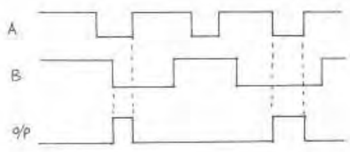
All gates mentioned in this series up to now have been positive logic NAND-gates which could be used for the NOR function with negative logic signals. However the SN7402N has four, two input, positive logic NOR-gates in the package. These are not commonly used, but can be very useful.

Fig. 1 T.T.L. NOR-gate



$o/p = \overline{A+B}$

Fig 2 Waveforms for NOR-gate



The basic arrangement is shown in Fig.1. and as can be seen is the same as a NAND -gate (CQ-TV 73 p.11) but for the extra transistors VT3 & 4 which duplicate VT1 & 2. VT2 & 3 form the actual NOR-gate part since, if the base of either one is taken high, then the gate output goes low. Whereas both must be taken low to make the gate output go high. See Fig.2. This then is the exact opposite to the SN7400N NAND-gate. (It is also the same as an R.T.L. gate µL 914). It follows then that anything that the 7400 can do, can be done by the 7402 if the signals are inverted. For example a R-S bistable latch is shown in Fig.3. for NAND and Fig.4. shows same arrangement for NOR. Note that the symbol for the NOR-gate is different from the NAND-gate.

Fig 3. R-S Bistable using NAND gates

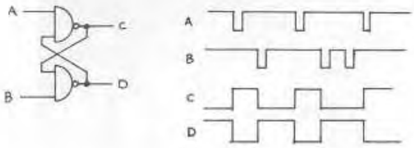
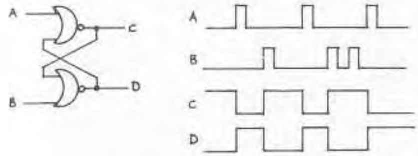


Fig 4. R-S Bistable using NOR-gates



There is a snag of course with using NOR-gates and that is that the two input gate is the only one available and so the main advantage of the 7402 NOR-gate is in avoiding the use of invertors in simple logic systems.

A good use for the NOR-gate is in the following circuits for generating short pulses. (Fig.5 to 8). R should be about 200 ohms to 1K ohms in all cases and C may be up to 1000µF.

Fig 5 Generating Short Pulses — Neg Pulse from Pos Edge

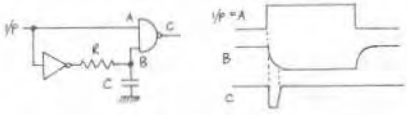


Fig 6 — Neg. Pulse from Neg. Edge

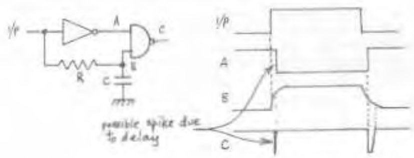


Fig 7. — Pos. Pulse from Neg Edge

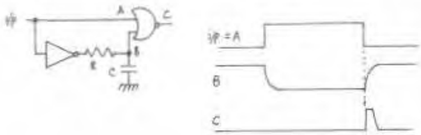
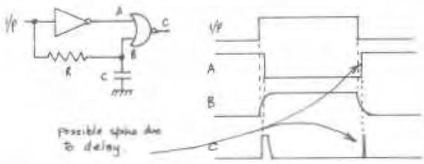


Fig 8 — Pos. Pulse from Pos. Edge



Note that integration is used rather than differentiation since there are no overshoots from the unwanted edges and therefore no risk of damage to the gates.

Figs. 9 & 10 show a means of generating very short pulses by using the delays of gates in series. There are no other components! Such a pulse is sufficiently long to clock or clear a bistable.

Fig 9 Producing Short Pulses without R-C Networks

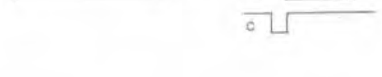
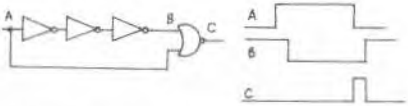


Fig 10. Using NOR-gates



Figs. 11 & 12 show the use of NAND and NOR-gates in pulse edge delaying (or pulse widening — or narrowing — depending on how you view it).

Fig 11 Pulse Stretching — using NAND-gate

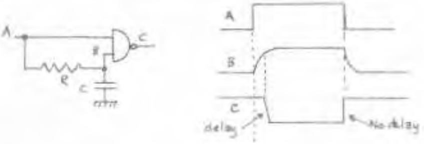
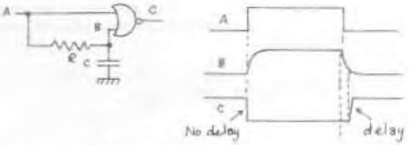


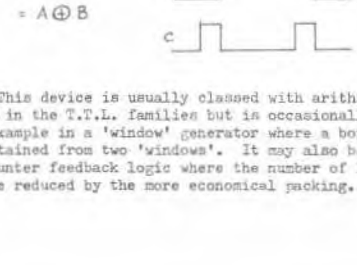
Fig 12 — using NOR-gate



The Exclusive OR gate SN7486N

This impressive title describes the system shown in Fig.13. Four such systems are put inside one package.

Fig 13 Exclusive-OR gate 7486N

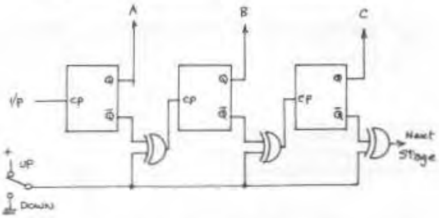


$C = A\bar{B} + \bar{A}B$

$= A \oplus B$

This device is usually classed with arithmetic units in the T.T.L. families but is occasionally useful, for example in a 'window' generator where a border can be obtained from two 'windows'. It may also be useful in counter feedback logic where the number of I.C.'s may be reduced by the more economical packing.

Fig 14. 3 stage Binary Up/Down Counter



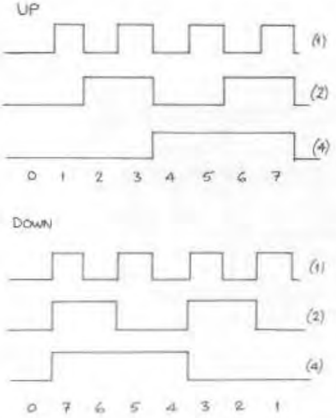
A good use for the 7486 is as a switchable waveform invertor for example in a binary up/down counter as Fig.14 shows. The truth table for the Exclusive-OR gate is shown here and it can be seen that the output is a 1 only if A & B are different. Looked at in another way, if B is 0 then the output is A or if B is 1, the output is $\bar{A}$.

So using one of these gates between bistable will invert, or not, the waveforms at will from a control switch.

A	B	O/P
0	0	0
1	0	1
0	1	1
1	1	0

Fig.15 shows the waveforms for such a counter. Note that changing the control switch will falsely clock the counters.

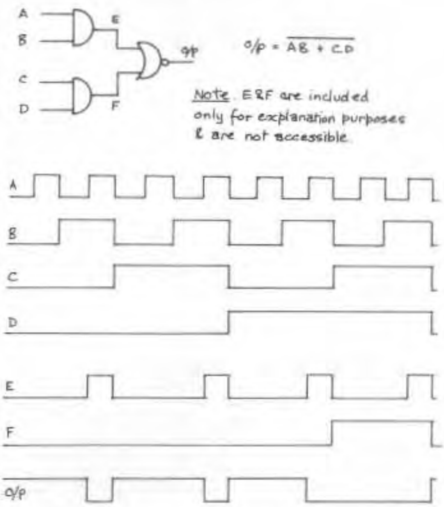
Fig 15. Counter Waveforms.



The AND-OR-NOT gate SN7451N

This is another strangely-titled device consisting of several gates within the same unit. Two complete systems are included in the same package. Fig.16 shows the details. The waveform diagram looks formidable but in fact shows all the 16 possible variations of input conditions. The output waveform still seems to be strange even so. However the gate can be used as a change-over switch as Fig.17 shows or as a 2-way 2 pole change-over switch as Fig.18 shows. Compare this with Fig.19 which shows the same system made from NAND gates. Note that the output is inverted from the AND-OR-NOR arrangement.

Fig 16 AND-OR-NOT gate 7450 or 7451



Note. E&F are included only for explanation purposes & are not accessible

Fig 17. Change-over Gate using 7451

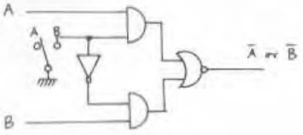


Fig 18 Change-over Gate - Double Pole - using SN7451N AND-OR-NOT - gate

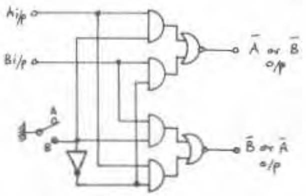
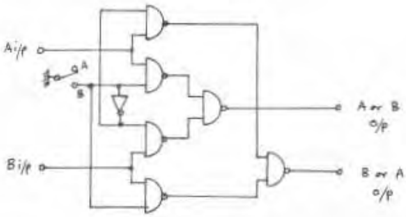


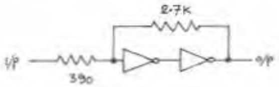
Fig 19 Change-over Gates - Double Pole



Simple Schmitt Trigger

Fig.20 shows how this can be made from two invertors. The output has the same phase as the input and so the feedback is positive causing a rapid change of state with a slowly changing input.

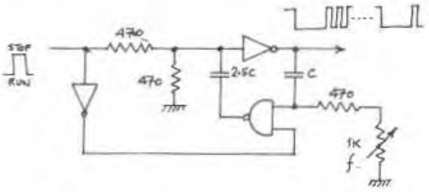
Fig 20 Simple Schmitt Trigger



The Gated Multivibrator

This arrangement consists of a multivibrator which is forced to stop and start by means of an external pulse - e.g. Mixed Blanking. It will always start with the same phase and since it should have the same frequency all the time it can be used as a source of vertical lines for grille generators, colour bars, etc., etc.

Fig 21 Gated Multivibrator - using simple gates

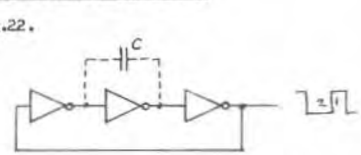


The two 470 ohm resistors are effectively in parallel during oscillation, hence the increased value of the associated capacitor. When the input is high, however, the 470 ohm resistors make a potential divider and the inverter half of the multivibrator is turned permanently 'ON'. This prevents further oscillation. The two-input gate is used to help the stopping and starting and tends to keep the starting-up cycles shorter than they would otherwise be. Even so, the first pulse is about 30% wider than the rest. Juggling the values can minimize it. Frequency control is about 3 to 1 with the 1K ohm variable resistance.

It is possible to replace the first 470 ohm by a diode in which case the 2.5C becomes C.

The Simplest Multivibrator

Fig.22.



This must surely be the simplest oscillator of all! with no capacitor the frequency is about 30MHz which is approximately 3 delays (each about 12nS).

i.e. 1/36nS ≙ 30MHz.

Adding a capacitor lowers the frequency. e.g. 220nF gives 50KHz with 2:1 mark/space ratio. If a squarewave is required, 220 ohms should be put in parallel with the capacitor.

Steps in Counter Waveforms

Fig.23 shows the usual effect observed in counters using multistage I.C.'s. This is due to changes in internal currents causing different voltage drops on the internal connecting leads.

Fig 23 Typical Counter Waveform

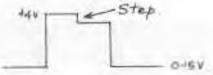
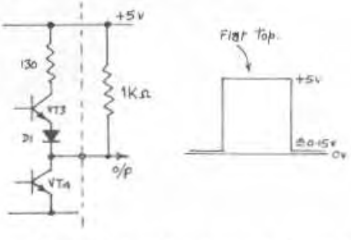


Fig 24 Removing the step

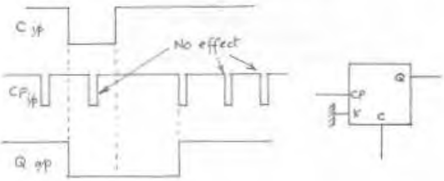


For normal use this does not matter at all, but if the counter outputs are to be summed together, to form a step wedge waveform, for example, then the steps in the waveforms cause unequal intervals. This can be overcome if the counter outputs are 'pulled-up' to +5V by 1K ohms resistors as Fig.24 shows. The effect of this is to put +5V on the output when the output is high - i.e. when VT3 is 'ON' and VT4 is OFF this reverse biasses the diode and turns it off (VT3 is ON and therefore holds the diode anode to +4.5V or so). There is therefore nothing to prevent the output being at +5V. Changing the conditions to VT3 'OFF' and VT4 'ON' does not effect matters greatly - the 1k ohm merely acts as a collector resistor for VT4 and increases the dissipation somewhat. The output voltage swing is now 5V pp.

J-K bistables as a latch

The J-K bistable, if both J & K are taken high, acts as a straightforward binary bistable. If the K input is earthed, though, the bistable can change in one direction only - from Q low to Q high. This can be put to use in the form of a latch, or memory, which cannot be upset by further pulses. Fig.25 shows the details. The bistable is cleared Q low by the clear pulse which overrides all other conditions. The clock pulse during clear is ignored but the first pulse after the trailing-edge of the clear pulse clocks the bistable Q high. Subsequent clock pulses have no effect until the bistable is again cleared.

Fig 25 J-K Bistable as a Latch



A cross-coupled R-S bistable behaves in the same way but has the disadvantage of giving signal out from one half during the clear pulse - it also needs voltage triggering and not negative edges as the bistable does.

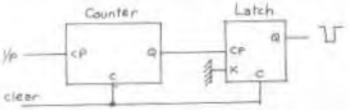
(See CQ TV 71 p.11 & 72 p.23). The bistable latch also enables longer pulses to be obtained from inputs by running off the trailing edges.

This gives a convenient way of counting pulses with the aid of a counter.

Counting clock pulses for timing signals

If the input to a bistable latch is taken from a counter than the latch output corresponds to the number of pulses counted - if both latch and counter are cleared together. Fig. 26 shows the basic system. In Fig.27 a practical arrangement for generating field blanking is shown - this is used in the CQ TV S.P.G. elsewhere in the magazine.

Fig 26 Using the latch



The counters trigger off negative-going edges as does the latch so if twice-line frequency pulses are used it takes 50 pulses (or 25 lines) to generate a negative-edge into the latch after the clear pulse is removed. The clear pulse has to be inverted between the latch and the counter since the counter requires positive pulses and the latch negative pulses.

Fig 27 Forming Field Blanking

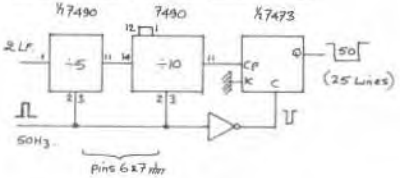
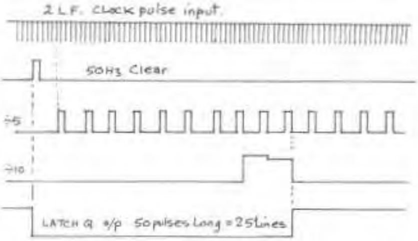


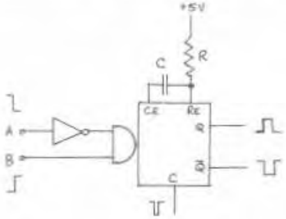
Fig 28 Waveforms for fig 27



Retriggerable Monostable

A recent addition to the T.T.L. range has been a dual retriggerable monostable SN74123N. This is a useful device in many ways, but it is not as stable with voltage or temperature as a 74121, nor has it the twin A input or the schmitt facility, but then you get two in a package (16 pins). It can also be cleared, or stopped during its output pulse by a negative clearing pulse.

Fig 29 Dual Retriggerable Monostable 74123N



The A & B inputs enable positive or negative input pulse edges to be used as the trigger. Fig.30 shows the results from the various input combinations. The timing pins cater for delays of up to 40 seconds. The resistor range is 300 ohms to 100K ohms. Typical figures are R10K, C 10nF, pulse = 35µS, R 22K, C 1µF, pulse = 3mS.

Fig.31 shows an example of the use of the retriggerable facility. •This facility in effect OR's together several such monostable pulses into one long one.

Fig 30. Input & Output Waveforms

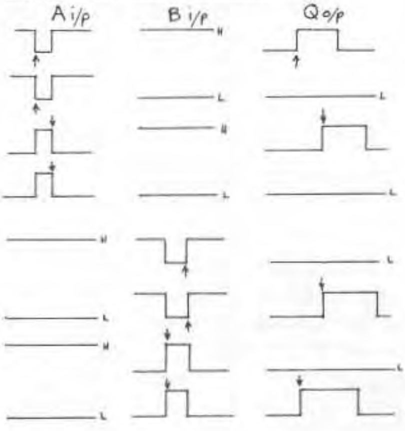
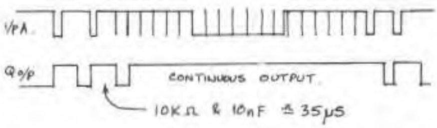


Fig 31. Example of Retriggering Action

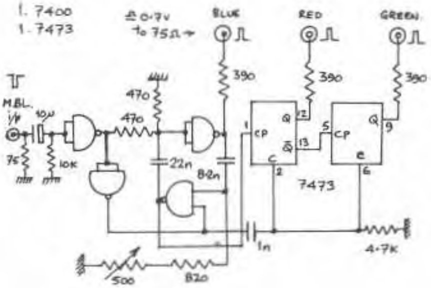


If the delay is set to be greater than $\frac{1}{2}$ line, then the twice line pulses during Syncs retrigger into a long pulse.

Simple Colour Bar Generator

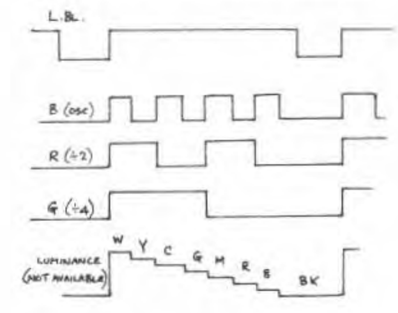
This generator is based on the one shown at the CAT 70 exhibition in Cambridge and also at the RSGB Exhibition.

Fig 32 Simple Colour Bar Generator



It consists of only two I.C.'s and produces Bars in order of descending luminance - the normal sort. Fig.33 shows the required waveforms, for the three colours.

Fig 33 Colour Bar Waveforms

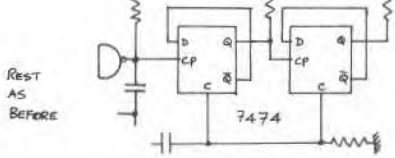


These waveforms have to occur only during the picture time and so Mixed Blanking is used as the drive signal.

It will be seen that the three waveforms can be derived from simple binary stages in cascade and that eight bars arerequired. So for a cascaded counter the clock frequency must be 8 times Line frequency unless a squarewave generator is used when 4 times is sufficient.

A simple multivibrator is used for this and consists of two NAND gates cross-coupled. The other two NAND gates are used as Buffer invertors to drive the multivibrator to force it to have the same phase on every line by preventing it from oscillating during the blanking period. Blanking is also used to reset the counter bistables. The signal level during blanking must, of course be black, but the first bar must be white which means that all counters must clock together after blanking. The simplest way of ensuring this is to use a bistable requiring positive clocking edges - the 7474 for instance, but a 7473 J-K bistable can be used if the Q̄ feed is used to clock the next bistable, and the Q feed to provide the output.

Fig 34. Using 7474 instead of 7473



Changing the oscillator frequency changes the widths of the bars and a repeat pattern can occur if the frequency is too high. The frequency control changes only one time - constant and hence only alternate bar widths.

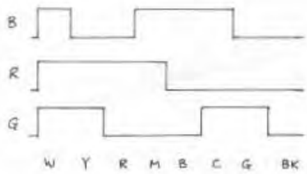
This does not really matter for Amateur use but can easily be overcome by a second pot on the other time constant. (or by tweaking the supply voltage).

The frequency stability of this oscillator is very poor with changing voltage so a stabiliser 5V supply should be used.

The outputs are arranged to give R.G.B. feeds and to give 0.7V Non-Composite signals into 75 ohms.

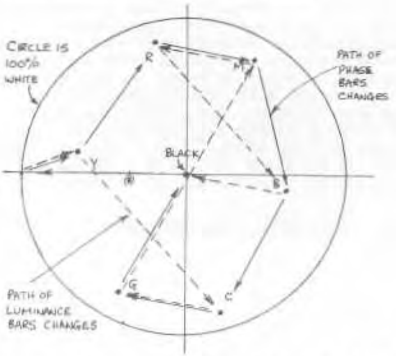
Colour Bar Generator for Phase Bars

Fig 35 Phase Bars



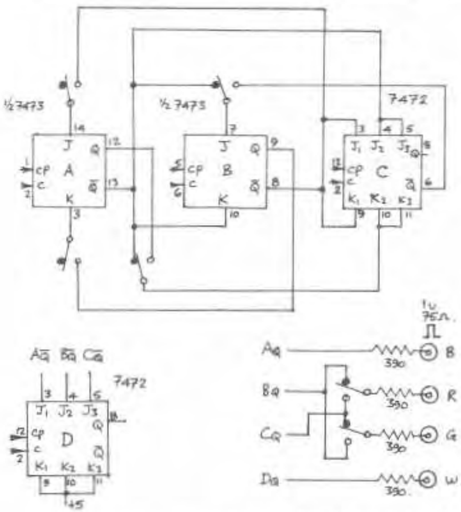
This is more difficult to make as the pulse sequence is not regular. See Fig.35. The reason for phase bars is that the Vectorscope display is clearer than for luminance bars because the stray lines joining the colours now travel clockwise round the display (in a hexagon) rather than across the display as for luminance bars. See Fig.36.

Fig 36 Vectorscope Display



The system is not common but is shown to give an example of a synchronous 8 bit counter with odd waveforms. The same counter can be switched to give luminance bars. Note that the G & R outputs then interchange. Also that the third bistable is a 7472 which has triple J & K inputs. These form NAND gates and all three must be high together in order not to inhibit the toggling - or conversely, any one taken low will stop the action. A fourth bistable is shown so that a white only pulse may be generated if required. This could then be the basis for a generator to make the various types of Bars where the white and thecolours have different amplitudes.

Fig 37 Colour Bar Generator – Luminance or Phase Bars



REST OF CIRCUIT AS FOR Fig.32. (CP & C PULSES)
4·7K MAY NEED TO BE REDUCED. 22n &8.2n SHOULD BE HALVED.
2 WAY 6 POLE SWITCH SHOWN IN LUM. POSITION.
BISTABLE D REQUIRED ONLY IF SINGLE WHITE BAR REQUIRED.

Errata

CQTV 72 p.22 Figs.18 & 19 gates shown as NAND should be AND gates.

CQTV 73 p.14 Fig.24 loading for C input should be 3 not 2. p.15 Fig.30 loading for P inputs should be 8 not 4. and in text 2 paragraphs below P-inputs have a loading of 2 whereas C inputs have a factor of 3.....

References

CQTV 71-74 - previous parts in this series.

Next Issue of CQTV

The series will continue with some more odds and ends with T.T.L. I.C's. CQTV 76 will also contain a genlock unit for use with the S.P.G. described elsewhere within this issue.

Acknowledgements

The author wishes to thank the Directors of E.M.I. Electronics Ltd. for permission to publish this article.

TELEVISION CAMERA PREAMPLIFIER USING FETS IN CASCODE

© Mullard Limited, 1970

The output of the Plumbicon camera tube can be represented by a current generator I_s in parallel with a capacitor C_p (approx. 12pF) as shown in Fig. 1. The output signal should be amplified with low distortion, and as little noise as possible added to it during amplification. Thus the preamplifier should have a level frequency response and a high signal-to-noise ratio.

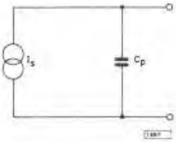


Fig. 1 - Equivalent circuit of the output of the Plumbicon tube

The flat frequency response is obtained by applying overall current feedback as shown in Fig. 2. In this case, and assuming that the amplifier voltage gain is high, $V_o = I_s \times R_f$. However, at frequencies above 0.5MHz the voltage gain begins to fall off, so the high frequency response is improved by partial decoupling of the feedback loop as illustrated in Fig. 3.

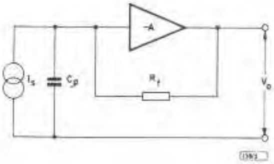


Fig. 2 - The camera preamplifier with feedback applied

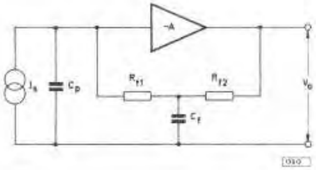


Fig. 3 - The preamplifier feedback loop shown partially decoupled

To meet the signal-to-noise ratio requirements, FETs are used in the first stage. This is because they are less noisy than bipolar transistors when operating with the given signal-source capacitive-impedance Cp. However, full advantage cannot be taken of the lower noise figures unless two FETs are used in a cascode circuit. With a single FET input stage, the Miller capacitance reduces the gain at high frequencies and the noise contribution from the second stage becomes too high. A cascode arrangement of a bipolar transistor and a FET is also too noisy. Thus two FETs in cascode give the best performance and the signal-to-noise ratio of the amplifier is now mainly determined by the noise of the input stage.

A complete circuit of the preamplifier is shown in Fig 4. The FET type BSV79 has been chosen for the input stage because its input capacitance is optimum for minimum noise ($C_{is} = C_p$), while its g_{fs}/C_{is} ratio is similar to other types of FET.

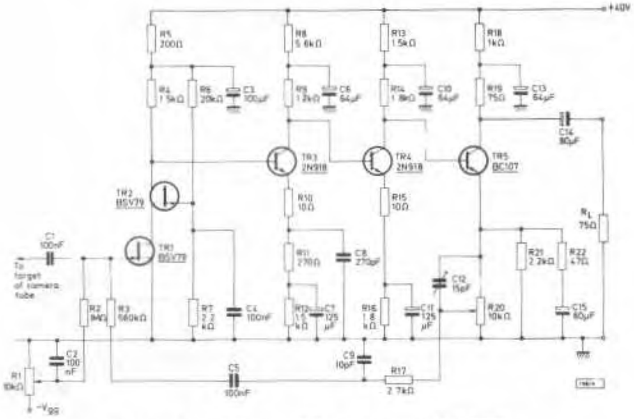


Fig.4 - Camera preamplifier using cascoded FETs type BSV79 in the input stage

PERFORMANCE

Forward transfer impedance V_o/I_s (frequency range 40Hz to 5.5MHz, $R_L = 75\Omega$): 1×10^6V/A

Output impedance: 75Ω

Signal-to-noise ratio (ratio of peak-to-peak output voltage to total r.m.s. noise voltage, at I_s = 300nApk-pk, through a frequency range of 40Hz to 5.5MHz): approx. 46dB

The r.m.s. noise voltage at the output of the preamplifier as a function of frequency is shown in Fig.5.

SETTING UP

The collector voltage of the output transistor TR5 should be set at 28V (by adjustment of potentiometer R1) to avoid clipping of the output waveform at maximum signal amplitude. The drain current of the FETs is then approximately 18mA.

The voltage gain is adjusted by the potentiometer R_{20} and the frequency response by the preset capacitor C_{12}.

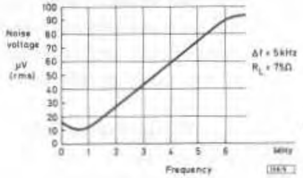


Fig.5 - R.M.S. noise voltage at the output as a function of frequency

Letter from New Zealand

Doug Ingham ZL2TAR

Doug Ingham ZL2TAR of Lower Hutt, New Zealand writes giving more details of the equipment used in his PAL colour tests. (Postbag C Q - T V 72).

The equipment

The colour bar generator is similar to the simple design in C Q - T V 60 and the encoder follows commercial PAL practice. The sync generator is perhaps the most interesting part of the equipment, the block diagram showing the main features of it (Fig 1).

Colour lock

The master frequency determining component is a quartz crystal oscillator on the colour subcarrier frequency of 4.43361875MHz, and all other pulses are indirectly locked to this through a phase lock loop and a system of frequency dividers, the main complications being due to the special frequency relationship between the PAL colour subcarrier and line and field frequencies. The main timing chain starts from a 2MHz crystal oscillator, controlled in frequency by a varactor. Frequencies of 3906.25Hz and 25Hz are obtained from the dividers and are used in the following manner. The 25Hz squarewave is filtered to form a sinewave and fed into a phasing type SSB exciter set to generate the lower side band. The output of this unit is 4.43361875 MHz minus 25Hz i.e. 3906.25Hz are compared in a phase detector. Note that 4.43359375MHz is exactly 1135 times the 3906.25Hz mentioned earlier. Thus if both crystal oscillators are exactly on frequency the 3906.25Hz spike always occurs at the same part of the cycle of the 4.4335975MHz sinewave, and the phase detector drifts relative to the 4.43361875MHz oscillator the phase detector output changes, altering the capacitance of the varactor and putting the 2MHz oscillator back into lock. The line and field frequencies derived from the 2MHz oscillator are thus locked to the colour subcarrier frequency.

Pulse timings

The 2MHz oscillator is fed to a system of frequency dividing flip-flops, which along with the rest of the generator features T.T.L. ICs of the SN7400 series (Mullard FJ series). Six dividers reduce the frequency to 31.25kHz (twice line frequency).

By choosing and gating pulses from various parts of the chain negative going edges, to trigger the pulse forming JK flip flops, can be produced at increments of ¼µ S. Since pulses take some time to pass through gates and JK flip flops the output pulses do not occur exactly at the desired ¼µ S intervals but, by careful choice, pulses to CCIR standards can be generated.

One trick was borrowed from an early Marconi S.P.G. to counteract the different amounts of delay suffered by the component parts of the composite sync waveform. Specially gated equalisng pulses (2 per line during the 7½ line field sync group, 1 per line during the rest of a field) are added at leading edge to line sync, equalising pulses, and broad pulses which is free from jitter.

Three further binaries reduce the frequency form 31250Hz to 15625Hz (line frequency), 7812.5Hz (PAL squarewave) and 3906.25Hz (phase lock loop).

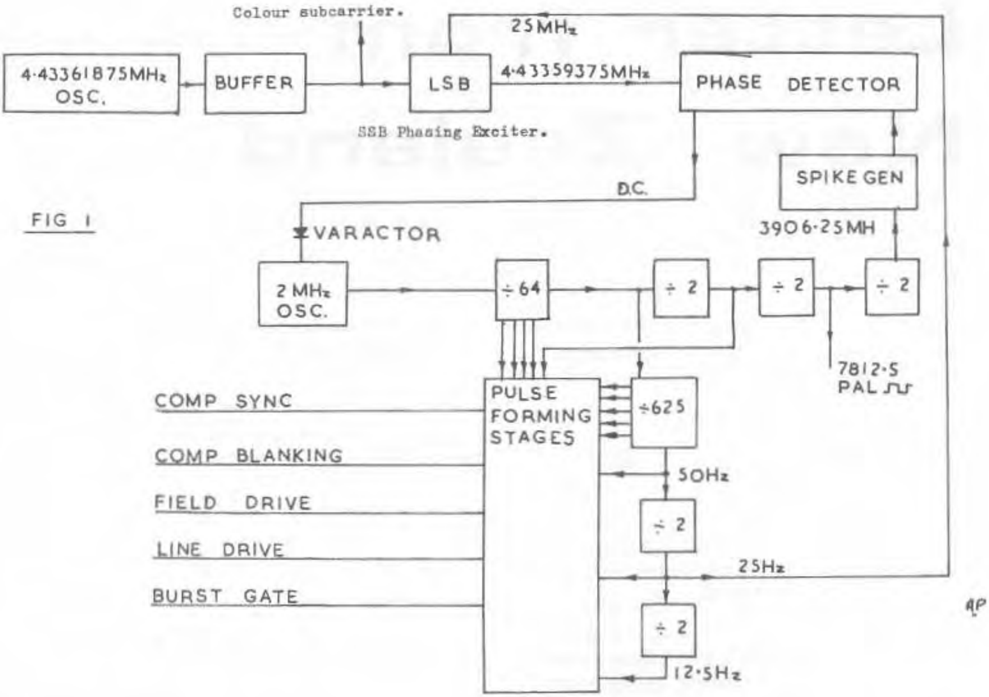


FIG I

Field timing

31250Hz is also fed to four ÷ 5 stages to give a total division of 625 down to field frequency (50Hz). The T.T.L. range of ICs used features a decade divider consisting of an independant ÷ 5 and ÷ 2 divider in each "Dual in Line" 14 pin package.

Various pulses from the ÷ 625 divider chain are gated to give negative going edges at the correct increments of ½ line (½H). These negative going edges are fed to JK flip flops to produce field drive, field blanking and gating pulses for the field sync group. The 50Hz is further divided to 25Hz (lower sideband generator) and 12.5Hz. Both of these and 7812.5Hz are used to generated BRUCH sequence burst blanking.

Pulse output stages

ALL pulses except the PAL SQUAREWAVE (1V p-p) use an output stage which gives 2V p-p when loaded with 75 ohms, and mostimportant has an output impedance something like 75 ohms to absorb any reflected energy if a pulse cable is incorrectly terminated. The 5V supply has its positive rail earthed; this feature permits direct coupling of the pulse outputs, eliminating those large electrolytics normally required (which often do unusual things to normal pulses). This arrangement also gives economy of DC drawn from the power supply. The same 5V supply (short circuit proof) runs the T.T.L. IC s. A -10V supply is used for the crystal oscillators, phase lock loop etc.

I use a similar pulse output circuit in my Pulse Distribution Amplifiers (P.D.A.s) substituting 2N3053 and 40319 in place of the last two transistors and feeding 4 or 5 output cables.

The SPG occupies 3½ ins of half rack (9½" wide).

A multiple PDA occupies 1¾ inches of half rack.

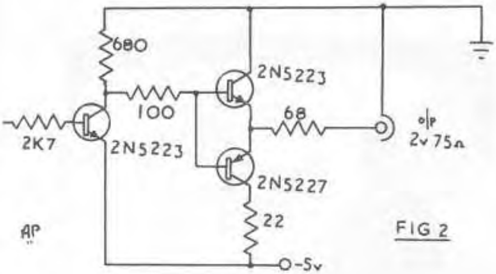


FIG 2

Random thoughts 1

On the subject of colour, a single vidicon colour camera described in the Journal of the SMPTE, April 1970 pp326 to 330 has promise for amateur use, producing colour without the use of spinning colour wheels or special vidicons. There are a few tricks however, but after these are taken care of, the rest is plain sailing. With a few modifications to their arrangement of Fig 7A (p328) a PAL output could be produced. One minor criticism of this camera (intended for cable TV and non-broadcast users) is that it used the green output of the camera head as though it was a luminance output, for the purpose of encoding. This would give rise to some colour errors.

Random thoughts 2

One aspect of ATV that always seems to be ignored is the subject of studio lighting. Rank Strand Electric (29 King St., London W.C.2.) has published a booklet "Lighting and layout for small TV studios" which admirably covers studio and control room aspects of lighting and layout for low budget stations i.e. ATV cable TV and educational TV. I found it most useful, even for my one studio camera, one telecine camera set up. You may too.

Over the air Lecture by GW6JGA-T-P

On the 8th October last year, John Lawrence GW6JGA/T, with the assistance of some willing helpers, gave an "over the air" lecture on amateur television to the Amateur Radio Society of the University College of North Wales, at Bangor.

The transmission point was the top of the Great Orme at Llandudno, and the reception point Bangor University, a path length of 13 miles (21Km). Permission had, of course, been granted by MinPosTel.

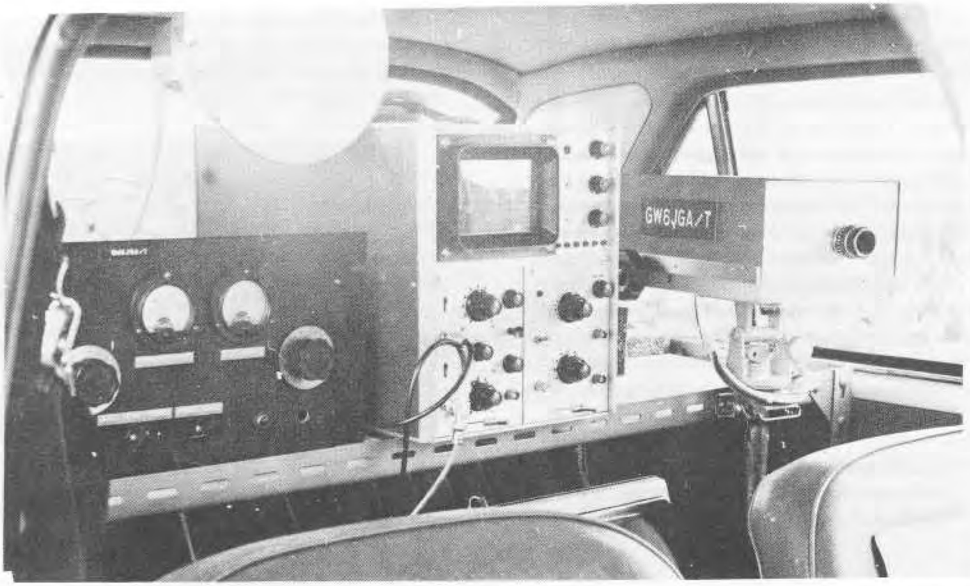
In order to make the GW6JGA/T station portable, an MG1100 was modified to make a miniature OB van. The back seat was removed and replaced by a shelf arrangement made of Handy Angle and blockboard, and this supported the sound and

vision gear, including a monitor and an ossilloscope. The camera mounting in front of this shelf can be seen in the photographs.

Unfortunately, it was not possible to get hold of a portable generator (a Honda had been hoped for) but help came from the Orme Tramway Terminus, who gave permission to connect up to the mains supply there. (The tramway foreman is a GW--- who wishes to remain anonymous).

Vision was transmitted on 70cm with accompanying sound on 2m. A 4m talk-back link was also set up for use in control and cueing. The transmitting aerial was a 6 over 6 and the receiving end used a J-Beam "Multibeam". The receiver feeder was over 100m and a BF180 preamp was fitted below the aerial.

About 80 people watched the lecture, a good response for the hard work put in by 'JGA/T together with his helpers G6ADD/T, GW3MZY, GW8DKI and other members of UCNWARS.



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